

ASSA: algorithms for stochastic sensitivity analysis.

Michiel J.W. Jansen
Biometris, Wageningen University & Research Centre
P.O. Box 100, 6700AC, Wageningen, The Netherlands
michiel.jansen@wur.nl

Various software products exist for stochastic sensitivity analysis (SSA, in contrast to deterministic sensitivity analysis). The book of Saltelli, Chan and Scott (2000; Appendix) presented an overview of existing software packages at the time. The software packages mentioned are closed in the sense that you can hardly change or add components. The section on generic algorithms in the appendix is still far from complete. Thus, there does not seem to exist a fairly complete, coherent, and documented collection of algorithms for SSA in a basic programming language like C or Fortran. The ASSA project has the purpose to begin filling this gap. The intention is to make the collection available in the public domain, in such a form that everyone can use the software freely and can suggest improvements or additions. The long-term goal is a collection of documented algorithms in the spirit of the famous series of Numerical Recipes (e.g. Press et al., 1992), but with a slightly different legal status.

Model builders should be enabled to incorporate the algorithms into their model software, for instance in order to accompany model statements with an indication of inaccuracy due to input uncertainty. Another application is inclusion of SSA algorithms into generic frameworks for building, coupling and analysing models.

The language used is ANSI C, written in such a style that translation into another basic programming language should pose no serious problems. The current version of ASSA frequently uses algorithms from Numerical Recipes in C (NRC; Press et al., 1992). Thus, one may only use this version of ASSA in applications where one is entitled to use the algorithms from Numerical Recipes. The NRC procedures used for ASSA serve mainly to allocate and free memory space for vectors and matrices, to generate uniform random numbers, and to calculate special functions relating to probability distributions.

In summary, the goals are:

- A gradually improving and extending collection of basic and advanced algorithms for SSA, leading to a moderate form of standardisation;
- uniform description of these algorithms via C-programs;
- a form of publication inviting comments and additions, while enabling flexible use of the algorithms.

Examples of algorithms:

- Sampling from the unit-hypercube, among which latin hypercube sampling with and without forcing rank correlation;
- inverses of distribution functions, transforming the uniform distribution into other distributions (normal, lognormal, beta, gamma);
- functions translating mean and variance, or quantiles, of a distribution into the standard parameters of that distribution;
- regression-based and regression-free analysis-of-variance-type sensitivity analysis.

The poster, which gives more details, is meant to evaluate the interest of other parties to contribute in any form to the project.

Press, W.H. & Teukolsky, S.A. & Vetterling, W.T. & Flannery, B.P., 1992, *Numerical recipes in C: the art of scientific computing*, second edition, Cambridge University Press, Cambridge.
Saltelli, A. & Chan, K. & Scott, E.M., 2000, *Sensitivity analysis*, Wiley, Chichester.